IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **BALLATO et. al**
Application Serial No.: **10/774,645**
Application Filed: **February 2, 2004**
Attorney Docket No.: **CECOM 5486**
For: **LATERAL FIELD EXCITATION OF BULK ACOUSTIC WAVES FROM AN IC-COMPLIANT LOW VOLTAGE SOURCE**

AMENDMENTS TO THE CLAIMS

Madame:

In accordance with the enclosed Remarks, please amend the claims in the above-identified application as follows:

1. (Currently Amended) An interdigital lateral field excitation Bulk ~~bulk acoustic~~Acoustic Wave transducer device, comprising:

a first comb of interdigital electrode fingers deposited on a surface of a piezoelectric substrate interleaves with an opposing second comb of interdigital electrode fingers deposited on said surface;

said first comb being connected to a first bus bar and said second comb being connected to a second bus bar, said first and second bus bars being conductive and defining an active region on said surface, said piezoelectric substrate having a substrate acoustic impedance;

a first ~~one~~ electrode of said first comb and a second electrode~~one~~ of said second comb having an opposite polarity and an acoustic impedance matching said substrate acoustic impedance, being paired, positioned parallel and proximate to one another further comprising a period, said period having a period gap, G1, separating said first electrode from ~~one~~ ~~and~~ said second electrode~~one~~, said period gap G1 having a first edge opposing said first electrode~~one~~ and a second edge opposing said second electrode~~one~~;

said period having a plurality of electrode edges separated by an electrode gap, G2, said electrode gap G2 being wider than, and parallel to, said period gap G1;

a dielectric coating covers at least a portion of said period;

an exciting AC voltage placed across said period generates a plurality of alternating lateral electrical fields that alternate in polarity and a plurality of piezoelectric

mechanical surface tractions produced at said electrode edges being spatially distributed over said surface;

said period having a given metallization ratio;

said device having a multitude of periods;

said alternating lateral electrical fields, said multiple periods, ~~and~~ said dielectric coating and the positioning of said first electrode and said second electrode within each period generate a low-voltage, planar, lateral field excitation Bulk Acoustic Wave ~~bulk acoustic wave~~ propagating away from said surface that suppresses production of a surface acoustic wave; and

said Bulk Acoustic Wave ~~bulk acoustic wave~~ provides a lateral electric field with a constant magnitude substantially uniform over said active area, reducing a plurality of electrode field intensity spikes, with a phase progression substantially parallel to said surface, producing a plurality of spatially distributed lateral electric fields pointing substantially in a single direction over said active area.

2. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim 1, further comprising said first bus bar and said second bus bar being separated by a width, W.

3. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim 2, further comprising each of said first comb ~~of electrode fingers~~ having a first length, L_1, and a first finger width, t_1.

4. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim 3, further comprising each of said second comb ~~of electrode fingers~~ having a second length, L_2, and a second finger width t_2.

5. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim 4, further comprising:

said active region having an electrode overlap width measured according to the formula:

$L_1 + L_2 - W$; and

an active region width that produces a plurality of acoustic waves.

6. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim 5, further comprising a tangential component of an electric field, E, that is parallel to said surface within said period gap G1 and remains unaltered by a dielectric permittivity of said dielectric coating.

7. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim 6, further comprising a normal component of said electric field, E, being perpendicular to said surface is modified according to the formula:

$E_{n1} = (\varepsilon_2/\varepsilon_1)E_{n2}$

where said E_{n1} refers to said dielectric coating, and said E_{n2} refers to said substrate.

8. (Canceled) The interdigital bulk acoustic transducer device, as recited in claim 7, further comprising said first comb of electrode fingers being composed of a conductive metal.

9. (Canceled) The interdigital bulk acoustic transducer device, as recited in claim 8, further comprising said second comb of electrode fingers being composed of a conductive metal.

10. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said dielectric coating is a dielectric coating strip;

said electrode gap G2 remaining uncovered; and

said portion being:

all of said second electrode~~one~~; and

a section of the period gap G1 adjacent to said second electrode~~one~~.

11. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said dielectric coating is a dielectric coating strip; ~~and~~

said electrode gap G2 remaining uncovered; and

said portion being:

a section of said first electrode~~one~~ adjacent to said period gap G1;

said period gap G1; and

a section of said second electrode~~one~~ adjacent to said period gap G1.

12. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said dielectric coating is a dielectric coating strip; ~~and~~

said electrode gap G2 remaining uncovered; and

said portion being:

a section of said first electrode~~one~~ adjacent to a narrowed period gap G1;

said narrowed period gap G1; and

a section of said second electrode ~~one~~ adjacent to said narrowed period gap G1.

13. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said dielectric coating is a dielectric coating strip;

said electrode gap G2 remaining uncovered;

said second edge of the period gap G1 extends underneath a rectangular ledge of said second electrode~~one~~; and

said portion being said period gap G1.

14. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said dielectric coating is a dielectric coating strip;

said electrode gap G2 remaining uncovered;

said second electrode~~one~~ having an overhanging ledge extending over said first ~~one~~ electrode and said period gap G1; and

said portion being said period gap G1;

15. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim 14, further comprising said overhanging ledge having a slope.

16. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said dielectric coating is a dielectric coating strip;

said electrode gap G2 remaining uncovered;

said first electrode~~one~~ having a first rectangular ledge extending over said first edge;

said second electrode~~one~~ having a second rectangular ledge extending over said second edge; and

said portion being said period gap G1.

17. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said conductive metal for the electrode fingers of said first and said second combs being aluminum;

said dielectric coating being a plurality of dielectric coating strips;

said electrode gap G2 remaining substantially uncovered;

a first dielectric coating strip covers an electrode edge of said first electrode~~one~~;

said second electrode~~one~~ having a rectangular ledge extending over said second edge of the period gap G1;

a second dielectric coating strip covers an electrode edge of said second electrode~~one~~; and

said portion being:

said electrode edge of the first electrode~~one~~;

said electrode edge of the second electrode~~one~~; and

said period gap G1 covered by a third dielectric coating strip.

18. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said conductive metal for the electrode fingers of said first and said second combs being aluminum;

said dielectric coating being a plurality of dielectric coating strips;

said electrode gap G2 remaining substantially uncovered;

a first dielectric coating strip covers an electrode edge of said first electrode~~one~~;

said second electrode~~one~~ having an overhanging ledge extending over said second edge of the period gap G1;

a second dielectric coating strip covers an electrode edge of said second electrode~~one~~; and

said portion being:

said electrode edge of the first electrode~~one~~;

said electrode edge of the second electrode~~one~~; and

said period gap G1 covered by a third dielectric coating strip.

19. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim 18, further comprising said overhanging ledge having a slope.

20. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer device, as recited in claim ~~9~~7, further comprising:

said ~~conductive metal for the electrode fingers of said~~ first electrodes and said second electrodes ~~combs~~ being composed of aluminum;

said dielectric coating being a plurality of dielectric coating strips;

said electrode gap G2 remaining substantially uncovered;

a first dielectric coating strip covers an electrode edge of said first electrode~~one~~;

said first electrode~~one~~ having a first rectangular ledge extending over said first edge;

said second electrode~~one~~ having a second rectangular ledge extending over said second edge;

a second dielectric coating strip covers an electrode edge of said second electrode~~one~~; and

said portion being:

said electrode edge of the first electrode~~one~~;

said electrode edge of the second electrode~~one~~; and

said period gap G1 covered by a third dielectric coating strip.

21. (Currently Amended) An interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, comprising:

a first comb of interdigital electrode fingers deposited on a surface of a piezoelectric substrate interleaves with an opposing second comb of interdigital electrode fingers deposited on said surface;

said first comb being connected to a first bus bar and said second comb being connected to a second bus bar, said first and second bus bars being conductive and defining an active region on said surface, said piezoelectric substrate having a substrate acoustic impedance;

a first electrode ~~one~~ of said first comb and a second electrode ~~one~~ of said second comb having an opposite polarity and an acoustic impedance matching said substrate acoustic impedance, being paired, positioned parallel and proximate to one another further comprising a period, said period having a period gap, G1, separating said first electrode from ~~one and~~ said second ~~one~~electrode, said period gap G1 having a first edge opposing said first electrode ~~one~~ and a second edge opposing said second electrode~~one~~;

said period having a plurality of electrode edges separated by an electrode gap, G2, said electrode gap G2 being wider than, and parallel to, said period gap G1;

a plurality of dielectric coating strips covers at least a portion of said period, said electrode gap G2 remaining substantially uncovered;

an exciting AC voltage placed across said period generates a plurality of alternating lateral electrical fields that alternate in polarity and a plurality of piezoelectric mechanical surface tractions produced at said electrode edges being spatially distributed over said surface;

said period having a given metallization ratio;

a first dielectric coating strip covers an electrode edge of said first electrode ~~one~~;

said second electrode ~~one~~ having a second ledge extending over said second edge of said period gap G1;

a second dielectric coating strip covers an electrode edge of said second electrode ~~one~~;

said portion being:

said electrode edge of the first electrode ~~one~~;

said electrode edge of the second electrode ~~one~~; and

said period gap G1 covered by a third dielectric coating strip;

said transducer having a multitude of periods;

said alternating lateral electrical fields, said multiple periods ~~and~~, said plurality of dielectric coating strips and positioning of said first electrode and said second electrode within each period generate a low-voltage, planar, lateral field excitation Bulk Acoustic Wave~~bulk acoustic wave~~ propagating away from said surface that suppresses production of a surface acoustic wave; and

said Bulk Acoustic Wave ~~bulk acoustic wave~~ provides a lateral electric field with a constant magnitude substantially uniform over said active area, reducing a plurality of electrode field intensity spikes, with a phase progression substantially parallel to said surface, producing a plurality of spatially distributed lateral electric fields pointing substantially in a single direction over said active area.

22. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 21, further comprising said first comb ~~of electrode fingers~~ being composed of aluminum.

23. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 22, further comprising said second comb ~~of electrode fingers~~ being composed of aluminum.

24. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 23, further comprising:

said first bus bar and said second bus bar being separated by a width, W;

each of said first comb ~~of electrode fingers~~ having a first length, L_1, and a first finger width, t_1; and

each of said second comb ~~of electrode fingers~~ having a second length, L_2, and a second finger width t_2.

25. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 24, further comprising:

said active region having an electrode overlap width measured according to the formula:

$L_1 + L_2 - W$; and

an active region width that produces a plurality of acoustic waves.

26. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 25, further comprising a tangential component of an electric field, E, that is parallel to said surface within said period gap G1 and remains unaltered by a dielectric permittivity of said dielectric coating.

27. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 26, further comprising:

a normal component of said electric field, E, being perpendicular to said surface is modified according to the formula:

$E_{n1} = (\varepsilon_2/\varepsilon_1)E_{n2}$

where said E_{n1} refers to said plurality of dielectric coating strips and said E_{n2} refers to said substrate.

28. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 27, further comprising ~~further comprising~~ said second ledge being rectangular.

29. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 28, further comprising said first electrode ~~one~~ having a first rectangular ledge extending over said first edge of the period gap G1.

30. (Currently Amended) The interdigital lateral field excitation Bulk Acoustic Wave ~~bulk acoustic~~ transducer, as recited in claim 27, wherein said second ledge is an overhanging ledge sloping downward away from said first electrode ~~one~~.

31. (Currently Amended) A method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, comprising the steps of:

depositing a first comb of interdigital electrode fingers on a surface of a piezoelectric substrate;

depositing a second comb of interdigital electrode fingers on said surface opposing, and interleaved with, said first comb, said piezoelectric substrate having a substrate acoustic impedance;

connecting said first comb to a first bus bar;

connecting said second comb to a second bus bar, said first and second bus bars being conductive and defining an active region on said surface;

aligning a first electrode ~~one~~ of said first comb and a second electrode ~~one~~ of said second comb into a pair, said first electrode ~~one~~ and said second electrode ~~one~~ being positioned parallel and proximate to one another and having an opposite polarity and an acoustic impedance matching said substrate acoustic impedance, said pair further

from ~~one and~~ said second electrode~~one~~, said period gap G1 having a first edge opposing said first electrode ~~one~~ and a second edge opposing said second electrode ~~one~~;

forming said period with a plurality of electrode edges separated by an electrode gap, G2, said electrode gap G2 being wider than, and parallel to, said period gap G1;

covering at least a portion of said period with a dielectric coating;

placing an exciting AC voltage across said period to generate a plurality of alternating lateral electrical fields that alternate in polarity and a plurality of piezoelectric mechanical surface tractions produced at said electrode edges being spatially distributed over said surface;

providing said period with a given metallization ratio;

forming a multitude of periods;

generating a low-voltage, planar, lateral field excitation Bulk Acoustic Wave ~~bulk acoustic wave~~ propagating away from said surface that suppresses production of a surface acoustic wave from said alternating lateral electrical fields, said multiple periods ~~and~~, said dielectric coating and positioning said first electrode and said second electrode within each period; and

providing a lateral electric field with a constant magnitude substantially uniform over said active area, reducing a plurality of electrode field intensity spikes, with a phase progression substantially parallel to said surface from said Bulk Acoustic Wave~~bulk acoustic wave~~, and producing a plurality of spatially distributed lateral electric fields pointing substantially in a single direction over said active area.

32. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 31, wherein a tangential component of an electric field, E, that is parallel to said surface within said period gap G1 and remains unaltered by a dielectric permittivity of said dielectric coating.

33. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in

claim 32, wherein a normal component of said electric field, E, being perpendicular to said surface is modified according to the formula:

$$E_{n1} = (\varepsilon_2/\varepsilon_1)E_{n2}$$

where said E_{n1} refers to said dielectric coating, and said E_{n2} refers to said substrate.

34. (Canceled) The method for exciting bulk acoustic waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 33, further comprising the step of forming said first comb of electrode fingers from a conductive metal.

35. (Canceled) The method for exciting bulk acoustic waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 34, further comprising the step of forming said electrode fingers of the second comb from said conductive metal.

36. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim ~~35~~33, further comprising the step of forming said dielectric coating with a plurality of dielectric coating strips.

37. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

forming said dielectric coating with a dielectric coating strip;

permitting said electrode gap G2 to remain uncovered; and

providing said portion over:

all of said second electrode ~~one~~; and

a section of the period gap G1 adjacent to said second ~~one~~ electrode.

38. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

forming said dielectric coating with a dielectric coating strip;

permitting said electrode gap G2 to remain uncovered; and

forming said portion over:

a section of said first electrode ~~one~~ adjacent to said period gap G1;

said period gap G1; and

a section of said second ~~one~~ electrode adjacent to said period gap G1.

39. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

forming said dielectric coating with a dielectric coating strip;

permitting said electrode gap G2 to remain uncovered; and

forming said portion over:

a section of said first electrode ~~one~~ adjacent to a narrowed period gap G1;

said narrowed period gap G1; and

a section of said second ~~one~~ electrode adjacent to said narrowed period gap G1.

40. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

forming said dielectric coating with a dielectric coating strip;

permitting said electrode gap G2 to remain uncovered; and

configuring said second edge of the period gap G1 to extend underneath a rectangular ledge of said second electrode ~~one~~; and

forming said portion over said period gap G1.

41. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

forming said dielectric coating with a dielectric coating strip;

permitting said electrode gap G2 to remain uncovered;

configuring said second electrode ~~one~~ with an overhanging ledge extending over said first electrode ~~one~~ and said period gap G1; and

forming said portion over said period gap G1.

42. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 41, further comprising the step of forming said overhanging ledge with a slope.

43. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

forming said dielectric coating with a dielectric coating strip;

permitting said electrode gap G2 to remain uncovered;

configuring said first ~~one~~ electrode with a first rectangular ledge extending over said first edge;

configuring said second electrode ~~one~~ with a second rectangular ledge extending over said second edge; and

forming said portion over said period gap G1.

44. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

selecting aluminum as said conductive metal;

forming said dielectric coating with a plurality of dielectric coating strips;

permitting said electrode gap G2 to remain substantially uncovered;

locating a first dielectric coating strip over an electrode edge of said first electrode ~~one~~;

configuring said second electrode ~~one~~ with a rectangular ledge extending over said second edge of the period gap G1;

locating a second dielectric coating strip over an electrode edge of said second electrode ~~one~~; and

forming said portion from:

said electrode edge of the first electrode ~~one~~;

said electrode edge of the second electrode ~~one~~; and

covering said period gap G1 with a third dielectric coating strip.

45. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

selecting aluminum as said conductive metal;

forming said dielectric coating with a plurality of dielectric coating strips;

permitting said electrode gap G2 to remain substantially uncovered;

locating a first dielectric coating strip over an electrode edge of said first electrode ~~one~~;

configuring said second electrode ~~one~~ with an overhanging ledge extending over said second edge of the period gap G1;

locating a second dielectric coating strip over an electrode edge of said second ~~one~~ electrode; and

forming said portion from:

said electrode edge of the first electrode ~~one~~;

said electrode edge of the second electrode ~~one~~; and

covering said period gap G1 with a third dielectric coating strip.

46. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 45, further comprising the step of forming said overhanging ledge with a slope.

47. (Currently Amended) The method for exciting lateral field excitation Bulk Acoustic Waves ~~bulk acoustic waves~~ with interdigital electrode fingers, as recited in claim 36, further comprising the steps of:

selecting aluminum as said conductive metal;

forming said dielectric coating with a plurality of dielectric coating strips;

permitting said electrode gap G2 to remain substantially uncovered;

locating a first dielectric coating strip over an electrode edge of said first electrode ~~one~~;

configuring said first electrode ~~one~~ with a first rectangular ledge extending over said first edge of the period gap G1;

configuring said second electrode ~~one~~ with a second rectangular ledge extending over said second edge of the period gap G1;

locating a second dielectric coating strip over an electrode edge of said second electrode ~~one~~; and

forming said portion from:

said electrode edge of the first electrode ~~one~~;

said electrode edge of the second electrode ~~one~~; and

covering said period gap G1 with a third dielectric coating strip.